Module Title: Motion Picture Engineering  
Code: EE5C1

Level: Year 5 of the MAI  
Credits: 10  
Prerequisites: Digital Signal Processing

Lecturer(s): Prof. Anil Kokaram

Terms: Semester 2  
Lectures/week: 2-3  
Labs/week: 3  
Duration (weeks): 11  
Total: 30  
Total: 33

AIMS/OBJECTIVES
Motion Pictures in the form of Digital Video accounts for more than 70% of all internet traffic today. R&D in this area has inspired new industries in digital media creation, online video streaming and video media sharing. Industrial Light and Magic, The Foundry, YouTube, Netflix, Vimeo, Skype, Sky Digital are just a few of the well known large companies that now successfully operate in this space.

Motion Picture Engineering prepared the student for a career in these industries including post-production tool development and video streaming. The first part (before the reading) week introduces the underlying ideas in motion estimation, object segmentation and statistical video processing in general. The second part after the reading week will investigate modern compression standards such as H.264, VP8 and VP9. The module also considers aspects of Deep Learning as they apply to Video. The module incorporates a bi-weekly seminar program with guest lectures from domain experts e.g. Netflix and Google.

Students develop practical skills in research, plugin development and testing that are common practice in companies developing tools for digital media. Students will be required to independently investigate leading research papers in the field and develop video processing plugins for Nuke (www.thefoundry.co.uk), a leading video-processing platform in the Cinema Post-Production industry.

SYLLABUS

- Objective Video Quality Measurement – state of the art objective quality metrics such as VQM and SSIM
- Motion Estimation – state of the art frameworks and implementations
- Optimisation – introduction to well-known optimisation strategies for image/video processing applications such as image/video segmentation and motion estimation. These include, Graph Cuts, ICM, Belief Propagation
- Deep Learning in Video – Recent topics in Deep Learning for motion estimation
- Video Compression – an introduction to state of the art compression standards such as HEVC and VP9 and the business landscape shaping the future of this industry.
RECOMMENDED TEXT(S)


There are many other text books on Image and Video Processing and Computer Vision available in the library which you may wish to consult. Google scholar, arxiv.org and IEEE Xplore are essential resources for the research papers you will access over the duration of the module. The library also has paper versions of many relevant journals.

LEARNING OUTCOMES

At the end of the module, students will be able to
1. Design tools in a commercial video processing platform,
2. Design visual algorithms for solving video-centric problems involving motion and texture
4. Assess critically the state of the art in motion estimation and video segmentation.
5. Assess critically the relative performance of competing video compression standards.
6. Analyse the performance of tools within video compression standards
7. Design and deploy transcoding strategies for video

TEACHING STRATEGIES

The module is mostly lab-based containing a mixture of tutorials and conventional lab sessions where students will be able to seek assistance on their development assignments. There will be approximately 20 lecture hours which will be run twice a week from the start of the semester. The guideline for a 10 ECTS module is for 250 hours of student effort including class hours.

ASSESSMENT MODE(S)

Assessment for 5C1 will be 100% based on Continuous Assessment. Assessment will be a mixture of algorithm design assignments and in-class tests. The students on the course will be guided through adapting assignments to complement their chosen project if possible.